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Laying Performance of Wareng Chicken under Free Choice Feeding and Different Cage Density

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ABSTRACT

The aim of the experiment was to explore the possibility of using free choice feeding technique under different cage density for unselected native chicken. Eighty hens of laying Wareng chicken were divided into two feeding systems. Half of them were fed complete commercial diet of 17% crude protein, with 2800 kcal ME/kg and the other half were subjected to free choice diet. The diets were in mash form and placed in sufficient feed troughs in front of each cage. Each cage was occupied by four or six hens. Free choice feeding hens were served with commercial concentrate (30% crude protein), ground corn and oyster shell, placed separately in feed troughs. Observation was carried out during 24 weeks laying period, starting from 20 to 44 weeks of age. The results showed that egg production (9.35% hen day), and the intake of feed (42.74 g/day), protein (7.01 g/day), energy (116.6 kcal ME/day), calcium (1.99 g/day and phosphorus (0.22 g/day) were not affected (P>0.05) by feeding system nor by cage density. The results however indicated that free choice feeding technique provided sufficient nutrients in supporting maximum egg production of unselected native chicken.

Key words: laying, Wareng chicken, free choice, cage density

INTRODUCTION

Indonesia as a developing country has struggled in utilizing local chickens as a source of meat and egg. The benefit of keeping native chicken by the village community was actually significant in providing immediate cash, meat for family and animal genetic preservation (Alders & Pym, 2009; McLeod *et al*., 2009). This emerging interest in native chicken has driven intensive native chicken farms and local chicken farmer groups to increase chicken production to meet the increasing native-chicken-meat demands.

Along with the increasing demand of native chicken products, nutrient requirements are also crucial as it can affect the economic efficiency of husbandry. The sophisticated methods and procedures of preparing diets, like for modern chicken have been practiced successfully, resulting in a very close to the meeting of the bird's physiological status needs (Narváez-Solarte *et al*., 2005; Costa *et al*., 2009). However, it is required a higher operational cost with sophisticated equipments. This condition becomes an obstacle for rising local chicken, so it might be wise to use the bird's ability in diet selection for nutrient requirements for maximum production. Feeding trials studies on Indonesian native chicken have been reported (Iskandar, 2005; Suci *et al*., 2005) and work on physiological aspect of protein turnover was also reported on Kedu chicken (Suthama, 2006). Whilst there is lack of research report on free choice feeding on Indonesian native chicken.

Free choice feeding has been a method that seems to be able to predict nutrient requirements of the chicken as it accommodates the needs of chicken of different breeds, under different climates (Henuk & Dingle, 2002) and it may be also under different environment such cage density. Chicken in fact could improve the balance between their nutrient requirements and their nutrient intake (Pousga *et al*., 2005). Henuk & Dingle (2002) stated further that choice feeding was becoming importance to small poultry producers in developing countries, such as Indonesia, as it could substantially reduce the cost of feed.

This study was an exercise of refreshing free choice feeding method applied to unselected native chicken, called Wareng. The chicken was a small size of laying type of chicken (Sartika & Iskandar, 2007; Sartika *et al*., 2008). Bodyweight of adult cockerel was about 1.3 kg and of hen was about 0.8 kg. The purpose of the experiment was also to see whether the choice feeding system could really fit in determining nutrient requirements of the chicken under different cage density.

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MATERIALS AND METHODS

Eighty Wareng hens age of 20 weeks were placed in wire cages each of 90 x 40 x 40 cm. Each cage was filled with 4 or 6 hens with initial average bodyweight of 840±91 g, occupying about 600 or 900 cm^2 per hen equal to 9.17 or 13.75 kg/m^2. Experimental diets consisted of complete commercial layer diet in one treatment and the other as free choice diet, consisted of three different feedstuffs, which were commercial protein concentrate, corn and oyster shell. Complete layer commercial diet was given in one feed trough and the free choice diet was served in the other with the same size as feed trough for complete commercial diet, but divided into three equal size compartments, each for serving protein concentrate, corn or crushed oyster shell.

Nutrients content of all dietary treatments are presented in Table 1. Diets were served *ad libitum* for each feed trough compartment. Chicken however, had free access to the feed trough. Water was provided continuously from the tap into a U shape like PVC pipe, attached along the outer wall of cage. The cages were placed in a concrete building provided with sufficient light and ventilation.

Egg production was recorded daily and feed consumption was recorded weekly. Body weight gain was the different between final (at 44 weeks old) and initial (at 20 weeks old) bodyweight. Egg quality was measured from egg sampled at 3 consecutive days in a week when birds reached the age of 25, 32, and 40 weeks.

The experiment was designed by following factorial design of 2 diets (complete *versus* free choice diets) x 2 cage densities (4 *versus* 6 hens/cage). Each combination of treatment was replicated by 4. Due to the out break of disease, which was unavoidable, causing high mortality (about 27%) by the end of the experiment, hen day egg production was then corrected accordingly. Data were analyzed with analyses of variance and continued with analyses comparisons of treatment mean (Steel & Torrie, 1997).

RESULTS AND DISCUSSION

Mean values of egg production, feed consumption, feed conversion ratio (FCR), body weight gain and mortality are presented in Table 2. In general, there was no effect (P>0.05) of diet and cage density interaction for all variables measured. There was no difference (P>0.05) in egg production neither due to dietary treatment nor cage density. The no significant different of egg production between full and free choice fed birds was also indicated in Figure 1. This typical Wareng hen did not

Tabel 1. Nutrients content of feed and feedstuffs (as fed) used in the experiment[1)]

Feed and feedstuffs	Crude protein (%)	Gross energy (kcal/kg)	Calsium (%)	Phosphorus (%)	Moisture (%)	Price (Rp/kg)
Commercial layer diet	17.92	4017	3.72	0.62	10.97	4000
Commercial protein concentrate	31.20	2555	15.00	1.30	8.53	5000
Ground corn	7.46	4375	0.01	0.24	12.70	3500
Ground oyster shell	-	-	39.60[2)]	-	0.03	600

[1)] Chemically analyzed at accredited IRIAP proximate analysis laboratory; [2)] Panda *et al*. (2007).

Table 2. Egg production, feed consumption, feed conversion ratio, and bodyweight gain of Wareng hen under complete and choice feeds during the first 24 weeks laying period

Treatments	Egg production			FC (g/hen/day)	FCR	BWG (g/hen)
	(eggs/hen)	(% hen day)	(g/hen)			
Grand mean	32.51	19.35	1132	42.74	6.79	7.81
Diet (D)						
Complete	32.25	19.50	1068	41.13	7.14	9.75
Free choice	32.77	19.20	1196	44.35	6.44	5.85
SEM (0,05)	1.03	6.11	256	6.43	1.40	4.12
Cage density (C)						
4 hens	31.77	18.91	1107	41.93	6.64	9.75
6 hens	33.24	19.79	1157	43.54	6.95	4.85
SEM (0,05)	2.93	6.25	100	3.23	0.62	5.00
Interaction						
D x C	ns	ns	ns	ns	ns	ns

FC= Feed consumption; FCR= Feed conversion ratio; BWG= Bodyweight gain; ns= not significant (P>0,05).

produce egg as much as selected laying hens. The average hen day production was around 19% during the first 24 weeks laying period. Daily egg production as shown in Figure 1, showed almost the same pattern for all treatments, even at week 15-18 when there was an out break of disease, the egg production was drop. Egg production was again drop at week 22-25 of all hens in complete diets, but not in free choice diets.

The capability of Wareng hens in maintaining egg production on free choice diet, which was not different (P>0.05) from the hens on complete diet, indicated that this bird had ability in selecting and balancing their own nutrient requirements for egg production. The level of production was very low compared to even Fayoumi chicken, which was reaching up to 38.55% hen house (Khan *et al*., 2006). This small production of egg would be the cause of nutrients intake level, which were relatively small compared to the nutrients required by high egg producer hen.

Egg production of the hen in this experiment, which was not affected by cage density (ranged from 600 to 900 cm^2/hen), was also reported in using cage density of 450–750 cm^2/hen (Bishop, 2009). Dawkins *et al*. (2004) reported that differences among producers in provision of the environment quality for chicken had more impact on welfare than that of stocking density.

Daily feed consumption was not affected by treatments (Table 2). Average daily feed consumption was 42.74 g/hen. The pattern of daily feed consumption (Figure 2) of both hens on complete and free choice diets was generally the same, although at week 3 and week 14, hens on complete diet consumed more than that on

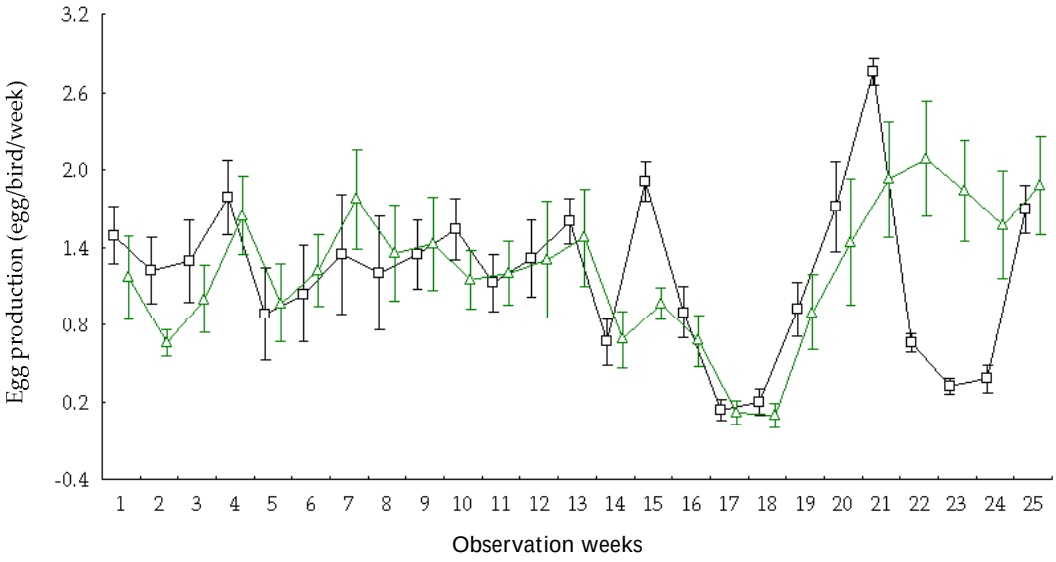

Figure 1. Egg production during the first 25 observation weeks of Wareng chicken (-□- = full feed diet; -△- = free choice diet).

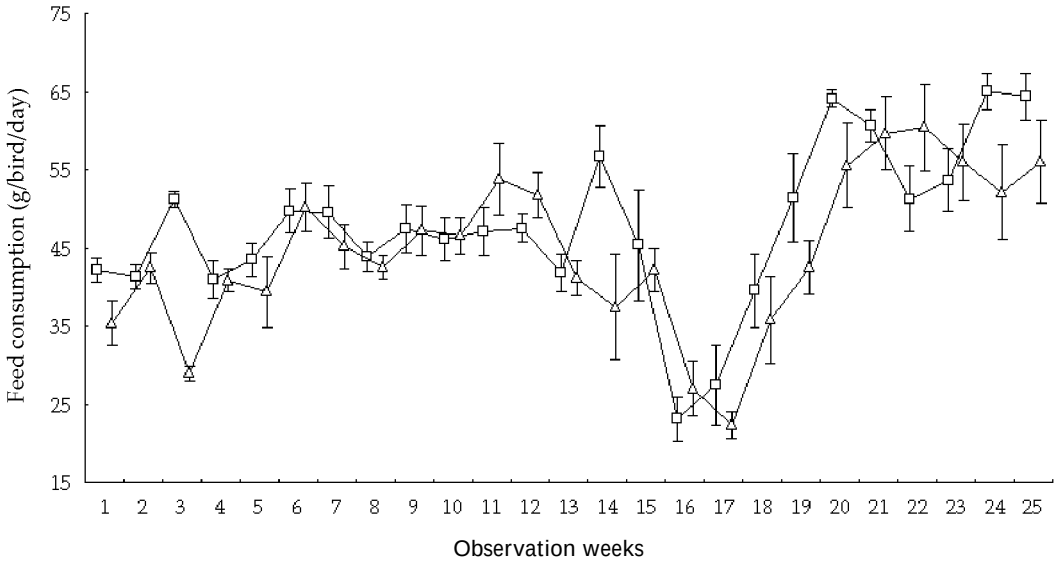

Figure 2. Feed consumption (on dry matter basis) during the first 25 observation weeks of Wareng chicken (-□-= full feed diet; -△-= free choice diet).

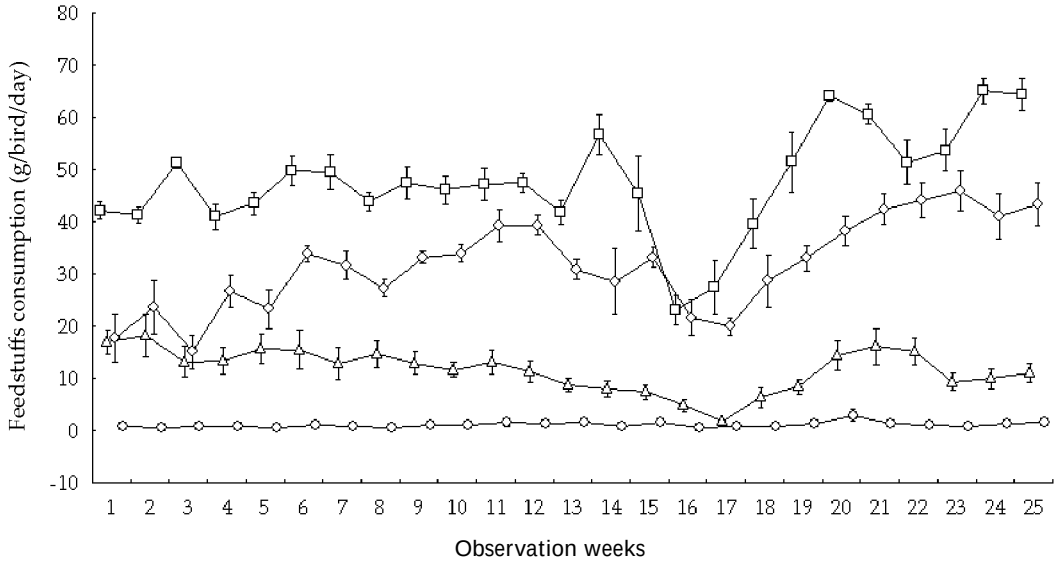

Figure 3. Feedstuffs consumption (as dry matter) during the first 25 observation weeks of Wareng chicken (-□-= full feed commercial layer diet; -Δ- = free choice commercial concentrate; -◊-= free choice ground corn; -○- = free choice ground oyster shell).

free choice diet. Further analysis on feedstuffs consumption by hens on free choice diet under two different cage densities (Figure 3) showed same pattern for 4 or 6 hen cage densities, taking portion of 63% corn, 32% protein concentrate and 5% oyster shell.

Feed conversion ratio (FCR) was also not affected by dietary treatments or by cage densities. The average FCR of each treatment was ranged from 6.44-7.14.

Bodyweight gain during 24 weeks laying period was very small with the average grand mean was around 7 g/hen. This bodyweight gain was not affected by treatments. The indicator of feeding laying hens, instead of egg production, was a bodyweight change either increase or decrease. The incredible increase of bodyweight of hen during laying period might not favorable for egg production. Bodyweight change about 7.8 g/hen (0.93% of initial bodyweight) was however considered unchanged as it compared to about 6%-9% in high egg producing hens (Chen *et al*., 2005). Thus, free choice diet was an appropriate alternative in feeding native laying hen.

Daily dietary energy, protein, calcium and phosphorus consumption were not affected by treatments (Table 3). The variables measured were also not significantly affected by the interaction between diet and cage density. The daily protein consumption was approximately

Table 3. Dietary energy, protein, calcium and phosphorus (on dry matter basis) of Wareng hen under complete and free choice diets during the first 24 weeks laying period

Treatment	Dietary protein consumption (g/hen/day)	Dietary ME consumption (cal/hen/day)	Dietary calcium consumption (g/hen/day)	Dietary phosphorus consumption (g/hen/day)
Grand mean	7.01	133.4	2.00	0.22
Diet (D)				
Complete	8.41	133.8	1.90	0.18
Free choice	5.61	132.8	2.09	0.26
SEM (0,05)	1.59	20.4	0.36	0.15
Cage density (C)				
4 hens	6.68	131.8	1.89	0.21
6 hens	7.34	134.8	2.10	0.23
SEM (0,05)	1.34	63.8	0.42	0.04
Interaction				
D x C	ns	ns	ns	ns

ME= Metabolizable energy as calculated 0.858 of gross energy (Nadeem *et al*., 2005); ns= not significant (P>0.05).

Table 4. Nutrient intake comparison of Wareng hen on complete or on free choice diets

	Complete diet		Free choice diet	
	Concentration	Daily dry matter intake	Concentration of the mixed ingredients	Daily dry matter intake
Feed		46.20g		50.17g
Crude protein	17.92%	8.41g	12.50%	5.61g
Energy	2850 kcalME/kg	134 kcal ME	2591 kcalME/kg	133 kcal ME
Calcium	3.72%	1,90g	4.67%	2.09g
Phosphorus	0.62%	0.18g	0.52%	0.26g
Feed cost (IDR)	5000/kg	231	3996/kg	200

Tabel 5. Egg quality of Wareng hen under complete and choice feeds during first 24 weeks laying period

Treatment	Whole egg weight (g/egg)	Yolk color (Roche scale)[1)]	Yolk weight (g/egg)	Haugh unit	Albumin weight (g/egg)	Shell weight (g/egg)	Shell thickness (mm)
Diet (D)							
Complete	33.21	11.27	11.54	88.68	18.34	3.36	3.21
Choice feed	33.13	9.24	10.69	88.83	18.22	3.54	3.38
SEM (0,05)	0.14	4.25	0.69	0.33	0.14	0.35	0.33
Cage density (C)							
4 hens	33.53	10.04	10.88	90.12	18.41	3.54	3.38
6 hens	32.94	10.49	10.92	87.43	18.13	3.36	3.21
SEM (0,05)	1.24	0.85	0.14	5.42	0.62	0.35	0.33
Interaction							
D x C	ns[2)]	ns	ns	ns	ns	ns	ns

[1)] The Roche Yolk Color fan with scale range from 1 for pale yellow to 15 for deep yellow; [2)] ns = not significant (P>0,05).

7 g/day. Daily metabolizable energy (ME) consumption of approximately 116 cal/day, which was calculated as much as 0.85 of gross energy (Nadeem *et al*., 2005). Whilst, approximate intake of calcium and phosphorus were 1.5 g/day and 0.22 g/day, respectively.

Comparative figures on feed, nutrients and feed cost between birds on complete diet and free choice diets is presented in Table 4. By calculating of the nutrients intake based on dry matter of diets, the concentration of the ration derived from free choice diet was lower than that of complete diet. The ability of Wareng hens in selecting balanced nutrients was indicated by the same amount of daily nutrients intake of the hens on free choice and on complete diet.

The cost of every kg of diet utilized by the hens of free choice diet was much cheaper than that of complete diet. Thus, daily feed cost of free choice feeding was lower by about 15.5%. Therefore, free choice feeding method was just appropriate method for feeding native chicken under intensive husbandry. In addition to that, the use of local feedstuffs such corn and oyster shell could be easily prepared and obtained locally.

The treatment did not affect the weight of the whole egg, egg mass, albumen, or shell egg (Table 5). The color of yolk of hen on free choice diet was significantly (P<0.5) more pale (9.24 of Roche Yolk Color Fan scale) than that of hens on complete diet (11.27 of Roche Yolk Color Fan scale). The approximate weight of the whole egg, yolk, albumen and shell were 33, 11, 18, and 3.5 g, respectively. The value of Haugh Unit approximately 88.75 was observed for all eggs, whilst the shell thickness was approximately of 3.29 mm.

In general, as mentioned by Henuk & Dingle (2002), the free choice feeding system offered more possibility of meeting various needs of flock of different breeds, including village chicken under different climates. The application of free choice feeding system for laying hens, combined with the number of the chicken caged together, should be carefully managed. The feed trough however has to be constructed to make easier the feeding handling and allow the bird to have access to the trough as free as possible. By using the conventional colony cage of 6 hens per cage and placing the feed trough in front of the cage, would much more convenient, although the birds were not able to express freely normal behavior, such as nesting, and dust bathing (Iskandar *et al*., 2009).

CONCLUSION

The hens had ability in selecting balanced diet required to support their maximal potential production. Free choice feeding system was also able to let the hens to fulfill their nutrient requirements with lower price. The feed and nutrient intake, egg production, and quality were not different in laying hens neither on free choice nor complete diet feeding.

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